DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name:	Clean Harbors of Braintree, Inc.
Facility Address:	P.O. Box 859048, 385 Quincy Ave., Braintree, MA 02184
Facility EPA ID #:	MAD053452637

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   XXX If yes - check here and continue with #2 below.
   _____ If no - re-evaluate existing data, or
   _____ if data are not available, skip to #8 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are nearterm objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   XXX If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

   _____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   _____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Clean Harbors of Braintree, Inc., (CHBI) is a RCRA-licensed hazardous waste treatment, storage and disposal (TSD) facility located at Hill Avenue (formerly 385 Quincy Avenue), in Braintree, Massachusetts. The site is located in an industrial area and is bordered to the east and south by a tank farm owned by Citgo and used to store bulk petroleum. The former General Dynamics Shipyard abuts the property to the north. The site is bordered to the west by property now or formerly owned by General Dynamics, with an automobile scrap yard owned by Flibotte Auto Salvage, located to the west beyond the General Dynamics property. The Weymouth Fore River is located north and east of the site beyond the former General Dynamics Shipyard and Citgo properties.

In October 1989, CHBI and the U.S. Environmental Protection Agency (EPA) entered into a RCRA Section 3008(h) Consent Order. In March of 1994, CHBI and EPA executed a Modification to the Consent Order to address Site Stabilization activities. The modified Consent Order required CHBI to design, install, operate, monitor, and maintain a groundwater recovery and treatment system along or near the northern property boundary. The objective of the groundwater recovery and treatment system is to cause a reversal of the natural hydraulic gradient in the shallow bedrock and overlying aquifer in order to control the migration of COCs in groundwater from the site. The reversal of groundwater is specified in the modified Consent Order to occur along an approximately 450-foot line between location A-A' and B-B', along the north-east boundary of the site. Groundwater at the site is classified as GW-2 according to the Massachusetts groundwater categories identified in the Massachusetts Contingency Plan 310 CMR 40.0932 (6). "Groundwater shall be defined to be in category GW-2 if it is located within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less. Category GW-2 groundwater is considered to be a potential source of vapors of oil and/or hazardous material to indoor air."

Laboratory analytical data collected during the RCRA Facility Investigation, Phase I, indicates that groundwater at the site contains chlorinated and aromatic volatile organic compounds (VOCs). The most commonly detected in the groundwater samples include benzene, 1,1-dichloroethane, cis- and trans-1,2-dichloroethene, 1,1-dichloroethene, ethylbenzene, toluene, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, vinyl chloride, and xylenes. Based upon the detection of similar COCs in site soils and the presence of COCs in groundwater along the upgradient property boundaries, the presence of these constituents in groundwater appears to be related to both past on-site contaminant sources, as well as, off-

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

site sources. Analytical data from monitoring events that occurred from 1999 to 2003 is located in table 1, as well as the applicable standards.

One or more of the following 38 compounds were detected in groundwater samples collected from individual monitoring wells sampled during March 1999; table blank identifies compounds and applicable standard.

Reference:

RCRA Facility Investigation Phase I, January 1992.
RCRA Facility Investigation Phase II, July 1999.
Progress Report for March and April 2003, May 2003.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

XXX If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) – skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

In March 1994, CHBI and EPA executed a Consent Order Modification to address site stabilization activities. XV.A.3 The modified Consent Order required CHBI to design, install, operate, monitor and maintain a groundwater recovery and treatment system along or near the northern property boundary. The objective of the system is to cause a reversal of the natural hydraulic gradient in the shallow bedrock and overlying aquifer in order to control the migration of COCs in groundwater from the site.

In order to provide analytical and hydraulic data to demonstrate that the groundwater recovery and treatment system is achieving the stabilization objectives, a total of nine monitoring wells were installed on the downgradient MHI property. These wells included monitoring wells CHI-6S/6D, CHI-30S, CHI-31S/31D, CHI32S/32D, and CHI 33S/33D. In addition, the Weymouth Fore River is located northeast of the site. Groundwater passing through the site is discharged to the Weymouth Fore River and, as a result, the existing area of groundwater is not expected to migrate beyond this boundary.

Reference:

Modification to Consent Order, RCRA Docket No. I-89-1050

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

XXX If yes - continue after identifying potentially affected surface water bodies.

_____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Groundwater at the CHBI site does discharge into a surface water body, the Weymouth Fore River. Groundwater at the site typically occurs at depths ranging from 5to 12 feet below ground surface. Potentiometric data collected from the site monitoring network indicates that groundwater flows in a north-northeasterly direction in both overburden and bedrock. As part of the site stabilization measures, groundwater recovery wells were installed in the east and northeast portion of the site, and now collect a vast majority of groundwater flowing to the northeast in shallow bedrock and overburden. Groundwater passing through the site is discharged to the Weymouth Fore River and, as a result, the existing area of contaminated groundwater is not expected to migrate beyond this boundary.

Reference:

RCRA Facility Investigation Phase I, January 1992.
RCRA Facility Investigation Phase II, July 1999.
Progress Report for March and April 2003, May 2003.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentrations of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentrations of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

XXX If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

In order to determine if groundwater discharging into surface water is likely to be "insignificant", applicable screening standards from the Massachusetts Department of Environmental Protection 310CMR40.0000 were utilized for this determination. First, the groundwater at the site typically occurs at depths ranging from 5 to 12 feet below ground surface. In addition there do exist occupied buildings on-site. According to 310CMR40.0932 the applicable groundwater standard is GW-2.

Dichlorodifluoromethane	100000	1000000
Vinyl Chloride	2000	20000
Chloromethane	10000	100000
Bromomethane	2	20
Chloroethane	10000	100000
Trichlorofluoromethane	100000	1000000
Acrolein	1000	10000
Acetone	50000	500000
1,1-Dichloroethylene	1	10

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

Iodomethane	10000	100000
Carbon Disulfide	10000	100000
Methylene Chloride	50000	500000
Acrylonitrile	10000	100000
Methyl Tert-Butyl Ether	50000	500000
Trans-1,2-dichloroethylene	20000	200000
1,1-Dichloroethane	9000	90000
2-Butanone	50000	500000
2,2-Dichloropropane	9	90
Cis-1,2-dichloroethylene	20000	200000
Chloroform	40	400
Bromochloromethane	10	100
1,1,1-Trichloroethane	4000	40000
1,1-Dichloropropene	5	50
Carbon Tetrachloride	20	200
Benzene	2000	20000
1,2-Dichloroethane	20	200
Trichloroethylene (Trichloroethene)	30	300
1,2-Dichloropropane	9	90
4-Methyl-2-Pentanone	50000	500000
Cis-1,3-Dichloropropene	5	50
Toluene	5000	50000
Trans-1,3-dichloropropene	5	50
Bromodichloromethane	50000	500000
1,1,2-Trichloroethane	20000	200000
1,2-Dibromoethane	3	30
2-Hexanone	10000	100000
1,3-Dichloropropane	50000	500000
Tetrachloroethene	3000	30000
Dibromochloromethane	100	1000
Chlorobenzene	500	5000
1,1,1,2-Tetrachloroethane	6	60
Ethylbenzene	4000	40000
Total Xylenes	6000	60000
Styrene	900	9000
Bromoform	800	8000
Isopropylbenzene	100000	1000000
1,1,2,2-Tetrachloroethane	20	200
1,2,3-Trichloropropane	10000	100000
N-Propylbenzene	10000	100000
Bromobenzene	10000	100000
2-Chlorotoluene	10000	100000
1,3,5-Trimethylbenzene	1000	10000
4-Chlorotoluene	10000	100000
Tert-Butylbenzene	10000	100000
1,2,4-Trimethylbenzene	100000	1000000
Sec-Butylbenzene	**	**

4-Isopropyltoluene	10000	100000
1,3-Dichlorobenzene	8000	80000
1,4-Dichlorobenzene	5	50
N-Butylbenzene	**	**
1,2-Dichlorobenzene	8000	80000
1,2-Dibromo-3-Chloropropane	1000	10000
1,2,4-Trichlorobenzene	500	5000
Hexachlorobutadiene	0.6	6
Diethyl ether	10000	100000
Tetrahydrofuran	50000	500000
Naphthalene	6000	60000
1,2,3-Trichlorobenzene	**	**
Dibromomethane	50000	500000

Out of the 38 compounds identified in groundwater samples taken in 1999, seven compounds sampled downgradient of the groundwater recovery and treatment system have been detected above the GW-2 standard. These compounds are bromomethane, chloroform, 1,1-dichloroethene, Trans 1,3-dichloropropene, 1,1,1-trichloroethane and vinyl chloride. The specific levels detected on the various monitoring events are listed in Table 1. CHBI believes the analytical data at six of the eight downgradient monitoring wells show a decreasing trend in VOC concentrations, with only CHI-30D and CHI32D indicating stable VOC concentration trends.

Reference:

RCRA Facility Investigation Phase II, July 1999.
Progress Report for March and April 2003, May 2003.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

XXX If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) Providing or referencing an interim-assessment[5]s appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors, which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

Discharge of "contaminated" groundwater into surface water is "currently acceptable". The furthest three-dimensional boundary of the groundwater contaminant plume is defined as the Weymouth Fore River. The plume is confined by the Weymouth Fore River and not continuing to increase, creating a larger environmental footprint. Upon entering the surface water body, three contaminants, bromomethane, 1,1-dichloroethene and vinyl chloride, are above the appropriate screening level (10XGW-2) as demonstrated in section five. This contaminant is present in monitoring wells CHI-30S/30D, CHI-31S/31D, CHI-32S/32D, and CHI33S/33D. It is important to note that the analysis of the data pertaining to these compounds suggest to be relatively stable. The following information is provided to demonstrate that the discharge of "contaminated" groundwater is "currently acceptable". The information has been gathered from toxicological profiles provided by the Agency for Toxic Substances and Disease Registry.

Bromomethane

---

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

Bromomethane is highly volatile, nearly all environmental releases of bromomethane are into the-air. Bromomethane, either as a gas or dissolved in water, has relatively low affinity for soils. However, based on an empirical relation between the bioconcentration factor (BCF) and the K ow (Neely et al. 1974), the estimated BCF for bromomethane is about 3. This low estimated BCF indicates that bromomethane should not significantly bioconcentrate (EPA 1986b). Most bromomethane will volatilize from water before extensive hydrolysis occurs.

1,1-Dichloroethene

Based on a vapor pressure of 592 mmHg (Verschueren 1983), most of the 1,1-dichloroethene released into the environment will ultimately partition into the atmospheric compartment. 1,1-dichloroethene is generally not found in surface water in high concentrations. 1,1- Dichloroethene in surface water is unlikely to partition significantly into aquatic organisms. The log Kow is 2.13 (Veith et al. 1985) and based upon this calculation, bioaccumulation in the human food chain is not expected to be significant for this compound.

Vinyl Chloride

Based on a vapor pressure of 2,660 mmHg at 25°C essentially all vinyl chloride in the atmosphere is expected to exist in vapor form (Eisenreich et al. 1981; Verschueren 1983). The primary removal process for vinyl chloride from natural water systems is volatilization into the atmosphere. Henry's law constant value of 1.2 atm-m 3 /mol at 10°C indicates that vinyl chloride should partition rapidly to the atmosphere. Vinyl chloride's high vapor pressure and low octanol/water partition coefficient (log Kow = 1.23) indicates that it bioaccumulates to a very limited extent (EPA 1982a). Relatively low tissue concentrations found in fish suggested that vinyl chloride is not biomagnified in aquatic food chains to any substantial degree.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

XXX If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations, which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

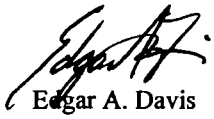
The groundwater monitoring program includes monthly hydraulic head measurements, and semi-annual collection and analysis of groundwater samples from the 12 monitoring wells CHI-9D, CHI-10, CHI29S/29D, CHI-30S/30D, CHI-31S/31D, CHI-32S/32D, CHI-33S/33D using low-flow sampling procedures in accordance with EPA publication "Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures" (EPA/540/S-95/504, April 1996). Groundwater samples collected from the 12 monitoring wells are analyzed for VOCs using EPA Method 8260B to assess concentrations of constituents to verify that the plume is not expanding beyond levels of concern and also verify the attainment of short-term goals.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

XXX YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Clean Harbors of Braintree, Inc. facility, EPA ID # MAD053452637, located at 385 Quincy Ave., Braintree, MA 02184. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

_____ IN - More information is needed to make a determination.

Completed by	(signature)		Date 02/11/04
	(print)	Edgar A. Davis	
	(title)	RCRA Facility Manager	
Supervisor	(signature)		Date 2/12/04
	(print)	Matthew Hoagland	
	(title)	Section Chief, RCRA CA Program	
	(EPA Region or State)	Region I – New England Office	

Locations where References may be found:

United States Environmental Protection Agency – Region I – New England Office
RCRA Files
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Contact telephone and e-mail numbers:

(Name)	Edgar A. Davis
(Phone #)	617-918-1379
(E-mail)	davis.edgar@epa.gov